

CHAPTER

10 Pier Columns

Description

Pier columns are an extension of the pier to a planned elevation in bedrock material and are usually the same size, or slightly larger, than the pier. They are ideally suited to canyons or hillside areas where there are limitations on the usual footing foundations, i.e., the need for approximately level topography and level underlying stratum. Footing foundations constructed in steep slopes are very costly because of the tremendous amount of excavation required. They are primarily a Cast-In-Drilled-Hole (CIDH) pile, except the means of excavation is something other than the conventional drilling method.

Specifications

The Special Provisions will contain a great deal of information regarding mined pier columns and should be reviewed along with the contract plans and *Standard Specifications* prior to the start of work.

Construction of pier columns is an excellent topic for the pre-construction conference, especially in regard to safety and excavation plans.

Almost all pier columns will have neat line excavation limits specified on the contract plans. Any excavation outside these neat lines shall be filled with concrete. The Contractor should be reminded of this requirement prior to the start of work. It should also be pointed out to the Contractor that care must be used in constructing the access road and/or work area so that the excavation does not extend below the top of the neat line areas.

Construction Methods

Methods and equipment used for construction of pier columns are dictated by several major factors. Among them is access to the work area, which is determined by the topography, and adjacent facilities such as existing structures, roads, and stream beds, and also by the type of equipment required to do the work. The cross sectional area of the pier shaft, depth of excavation, and the nature and stability of the material to be excavated are other major factors affecting the method and type of equipment to be used.

The above factors will vary significantly from project to project. Hence, there is a wide variation in construction methods and equipment used by contractors on different projects. Methods that have been used before include using a hoe-ram, jackhammer, or Cryderman ("shaft mucker"). Others have used chemical rock splitting. The most common method used is blasting with explosives.

Excavation

One of the first orders of work, after access roads are constructed to the pier site, is to establish survey control points. These points should be placed so that they not only provide control during excavation operations, but can also be used for pier construction or incorporated into control points for pier construction.

Soft material can be excavated with conventional methods, such as a Gradall, flight auger, clambucket and hand work. Hard material encountered in otherwise soft material requires other means. Since blasting is the most common method, it will be discussed the most throughout the rest of this chapter.

An air-track compressor type drill rig is commonly used for line drilling operations. The drill bits are 2½ to 5 inches in diameter and come in 20 foot lengths with screw-on attachments for greater depths. Another method is a rotary drill attached to a rotary table and Kelly bar.

The first phase of pier column excavation is to line drill the perimeter of the shaft at the neat line dimensions (the Contractor may elect to line drill slightly outside the neat line dimensions). Holes are usually drilled on 12-inch centers with additional holes placed inside the perimeter if needed. Lined holes should be blown out and filled with sand or pea gravel to facilitate blasting at different levels.

Handwork to some degree is required at the bottom of all pier columns.

Problem Areas

Because of the wide range of variables associated with pier columns, different problems can be expected with each project. Listed below are items common to most projects. All represent potential problems.

ITEM	POTENTIAL PROBLEM
Alignment	It can be difficult to maintain plumb drilled holes if extensive predrilling techniques are used. Consequently, the Contractor may elect to predrill the outside shaft dimensions.
Surveying	Be prepared to improvise. Access to the site and methods employed by the Contractor may require unique solutions. Work should be monitored as it progresses.
Access	The Contractor must provide safe access. Depending on excavation depth, this could vary from ladders to boatswain's chairs to suspended personnel cages to other means (review the Construction Safety Orders).
Blasting	A thorough review of the Contractor's blasting plan, if blasting is the option used to remove the bedrock material, is advised. Blasting should only be done by a licensed person with a Department of Industrial Safety (DIS) permit. This individual should supervise placing, handling, blasting and storage of explosive materials. Provisions must be made for handling traffic. Protection must be provided for existing facilities, utilities, etc. A galvanometer should be used to check for shorts in the wiring prior to blasting. Blasting mats, tires, dirt, etc. should be used to prevent flyrock from being scattered beyond expected limits. Proper warning signs should be provided along highways and roads near the blast site. No explosive material should be left in the area overnight. If it cannot be avoided, leave a guard overnight in the area. During the blast, guards should be placed at selected locations to prevent individuals from entering the blast area. Beware of "misfires." In general, this operation is not our responsibility. If you have any questions on the responsibility of Caltrans in regards to blasting, contact the Caltrans Headquarters Construction Safety Officer.
Shoring	Shoring is required in all areas that are not solid rock. In almost all cases, special designs are required in accordance with Section 5-1.02A of the <i>Standard Specifications</i> . Shoring systems can consist of concrete lining, steel or concrete casing, box-type shields, rock bolts, and steel or timber lagging. Refer to the Caltrans <i>Trenching and Shoring Manual</i> for shoring design and details.
Geology	Be prepared for unanticipated ground conditions, such as soil instability, groundwater, fissures, or simply material of lesser quality than that assumed for design purposes. Revisions may be necessary.
Concrete	Common to all mined shafts is the requirement that concrete be placed against the undisturbed sides of the excavation. The length of shaft contact could vary from a planned length in the lower portion of the shaft to the entire length of the shaft. The Special Provisions for these projects will usually require a minimum side contact area (generally 50%) with certain allowances for shoring left in place or to allow for concrete flow through stay-in-place casings. In other instances the shoring or lagging has to be removed as the concrete is placed. These provisions tend to complicate concrete placing operations and therefore care must be exercised to do the job properly. Close inspection is mandatory.

Safety

Extreme caution is absolutely necessary in order to protect not only personnel working in area, but the general public as well, since the potential for serious injury is ever present.

Safety railing must be erected near the shaft perimeter and adequate protection must be provided for personnel working inside the shaft.